

Using Satellite Imagery to Measure Waterfowl and Fishery Habitat Trends

Change Detection Analysis of Total Water Area in Currituck Sound – 1985 thru 2000

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Agenda Topics

- ▶ Imagery Data Sets
- ▶ The Easy Stuff – Total Water Area
- ▶ The Hard Stuff – Categorizing and Identifying Change Areas
- ▶ Misc. Interesting Stuff
- ▶ The Way Forward



Imagery Datasets

- ▶ Landsat – 5 Satellite, Path 014 Row 035
 - ▶ 19850722
 - ▶ 19900906
 - ▶ 19950904
 - ▶ 20000816
- ▶ 6 multispectral bands (28.5 meter/96 foot pixel), 1 thermal band
 - ▶ Blue, Green, Red, Near-Infrared (NIR), Shortwave-Infrared (SWIR)
 - ▶ Each band has a unique reflectance signature of land/water features



Landsat Imagery Composites



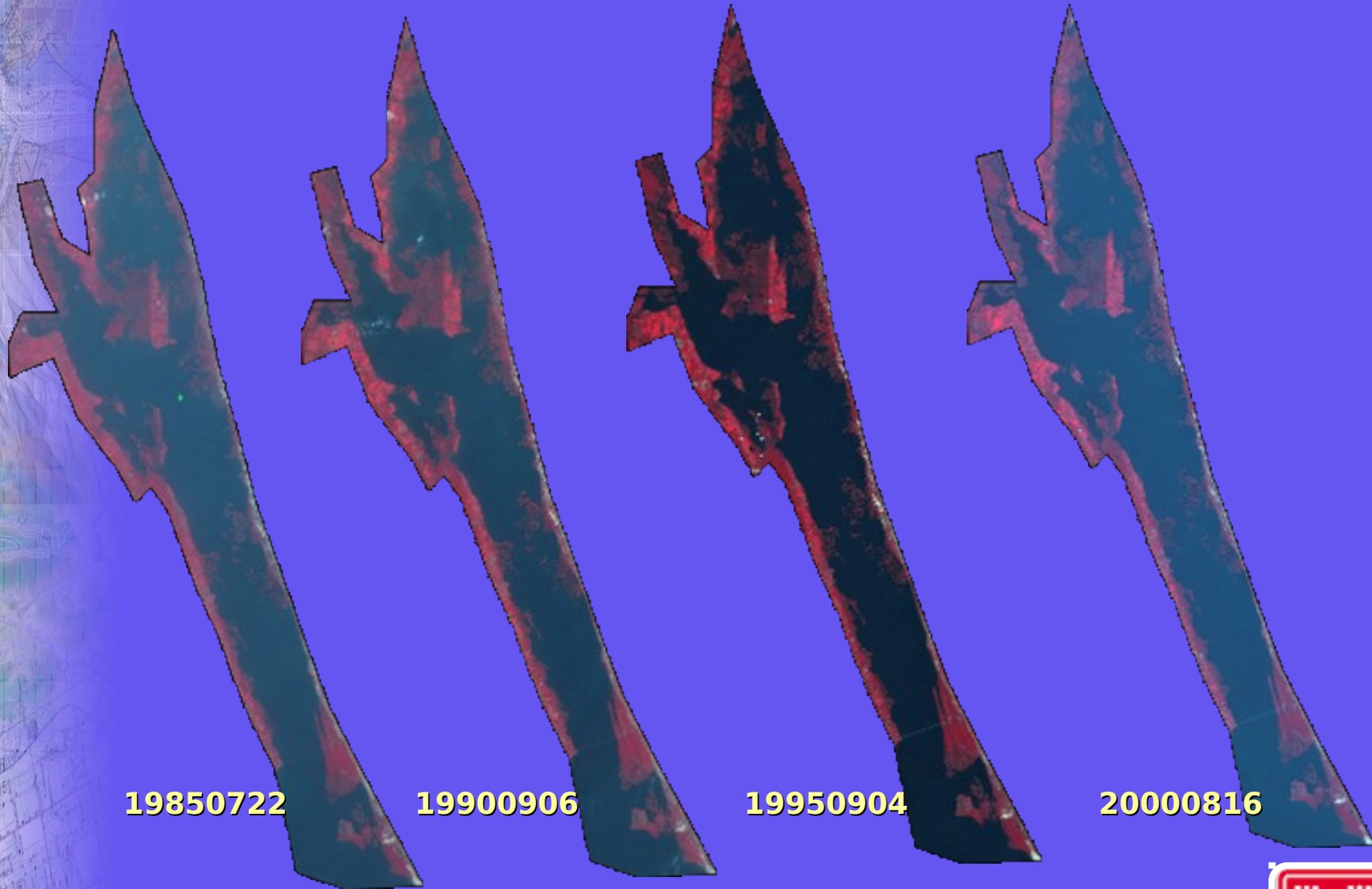
True Color Composite (RGB - 3,2,1) NIR False Color Composite (RGB - 4,3,2)

Landsat Imagery Composites



SWIR False Color Composite (RGB - 7,5,2) SWIR/NIR False Color Composite (RGB - 5,4,2)

Currituck Sound 1985-2000



19850722

19900906

19950904

20000816

The Easy Stuff – Total Water Area

- ▶ Theory – loss of Marsh over time = loss of Waterfowl & Fishery Habitat
- ▶ First Step – measure total water area over same footprint over set time period
- ▶ Can not detect change with eyeballs (at least not too well)
- ▶ Need to use image processing software with advanced algorithms to detect change at pixel level



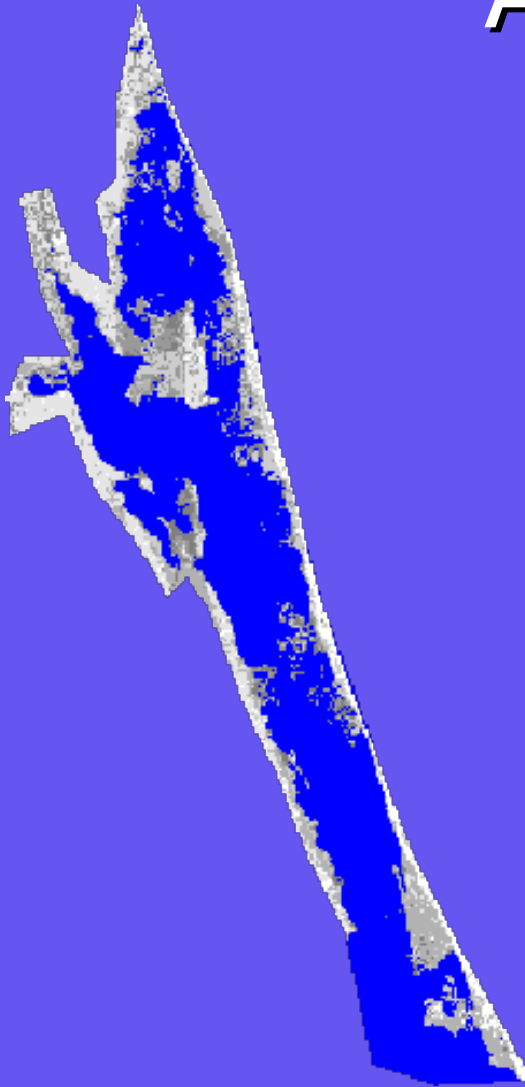
The Easy Stuff – Total Water Area

4 Currituck Study Area Images

- ▶ ERDAS Imagine 9.1 Image Processing Software
- ▶ Ran ISODATA Unsupervised Classification
- ▶ 10 classes initially chosen to easily identify water pixels
- ▶ First 4 classes returned as Water
- ▶ Using area calculation (Raster Attributes) totaled water pixels (# of pixels x 96 foot pixel) to get acres as output



The Easy Stuff – Total Water Area



- ▶ 19850722 – 151,897 acres
- ▶ 19900906 – 151,511 acres*
- ▶ 19950904 – 155,018 acres
- ▶ 20000822 – 155,657 acres

* Adjusted number based on several popcorn clouds



The Hard Stuff – Categorizing and Identifying Change Areas

- ▶ Increase of 3,760 Water Acres from 1985 – 2000 = 2.42 %
- ▶ With quantifiable increase of water area – challenge is to identify where
- ▶ Co-registration of imagery data subsets is critical (also very hard to do with Landsat)
- ▶ A one-pixel shift can equate to a large number of false positives



The Hard Stuff – Categorizing and Identifying Change Areas

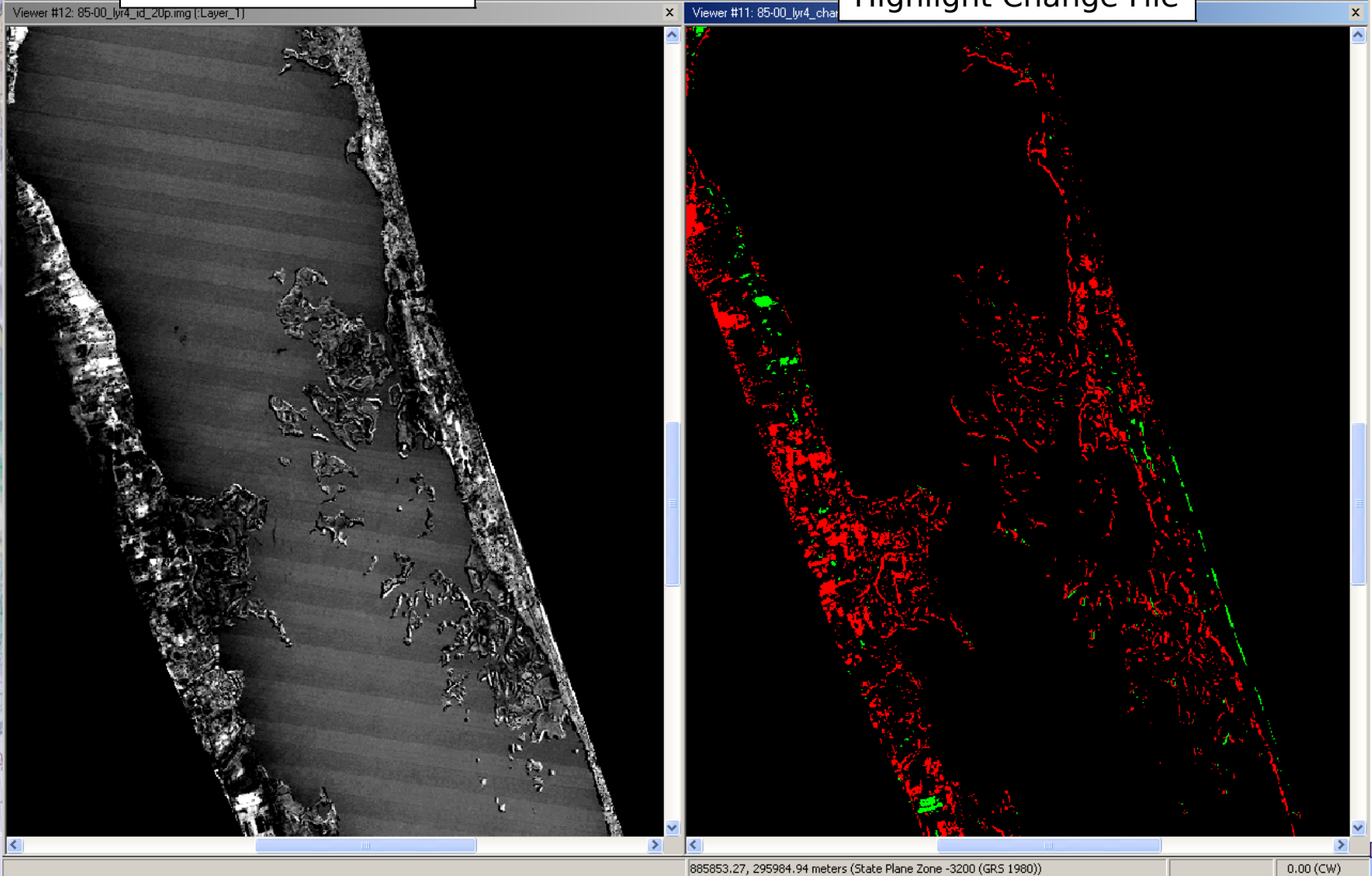
- ▶ ERDAS Imagine's Change Detection process creates two resultant files
 - ▶ Image Difference File – this image is the direct result of subtraction of the Before image (1985) from the After image (2000)
 - ▶ Highlight Change File – is a five class thematic image (Decreased, Some Decreased, Unchanged, Some Increase, Increased)



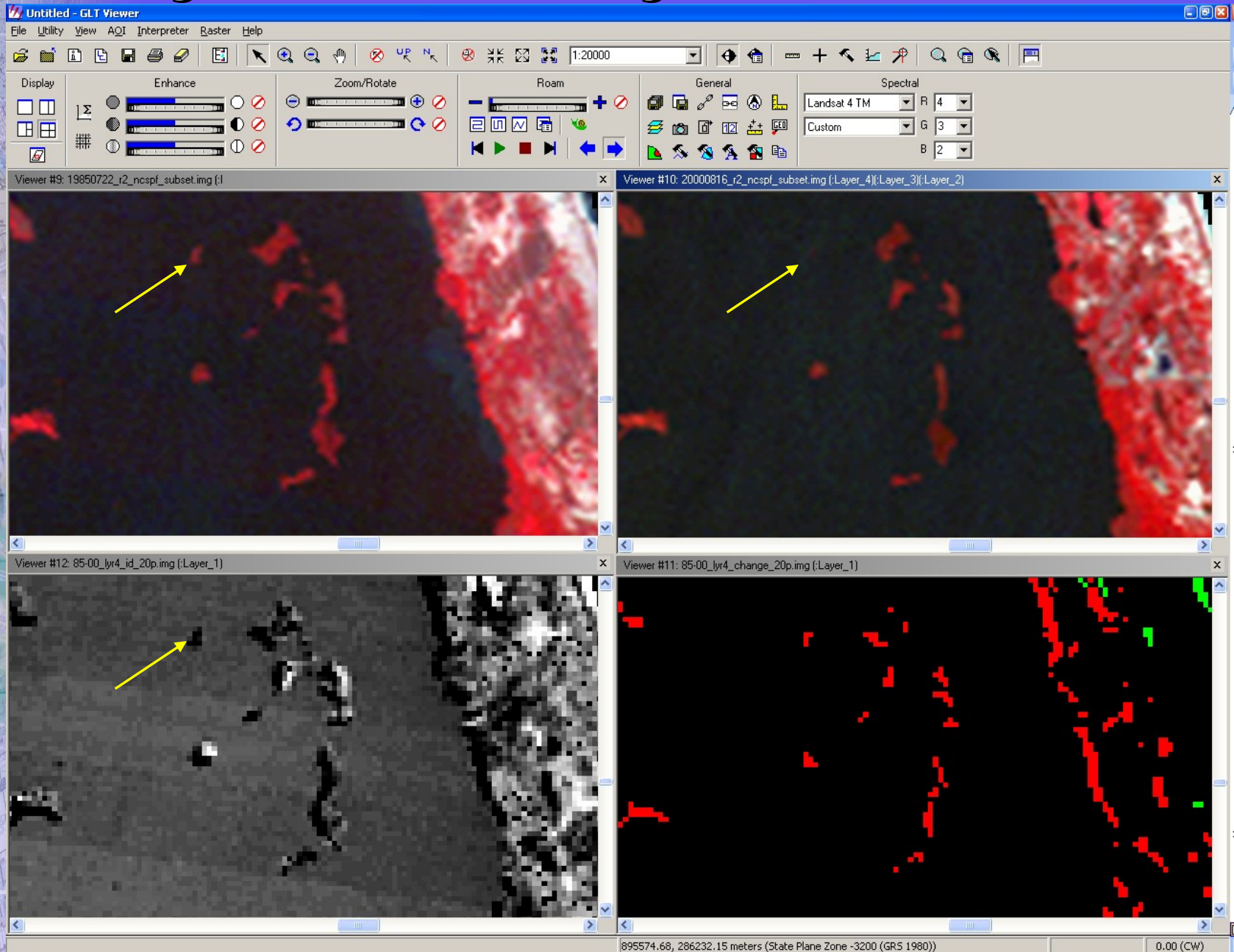
1985 – 2000 Change Detection Results Using Band 4

Image Difference File

Highlight Change File



Algorithms – Making the Hard Easier

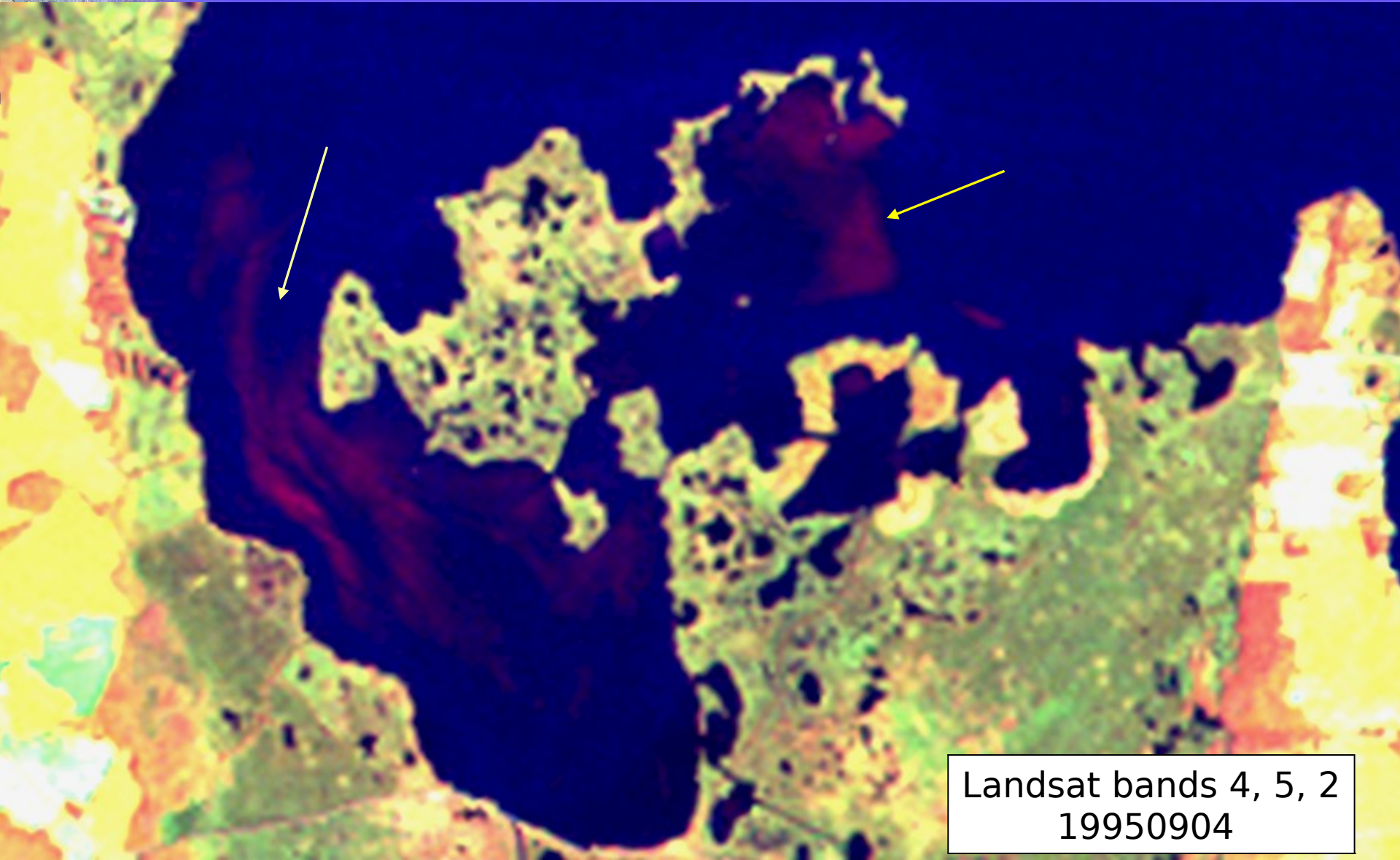


Now Back to the Hard Stuff

- ▶ Second Step – Now that the change areas are identified, need to categorize specific areas of change
- ▶ Third Step – Link areas of change to impact to habitat areas
- ▶ Fourth Step - . . .



Misc. Interesting Stuff



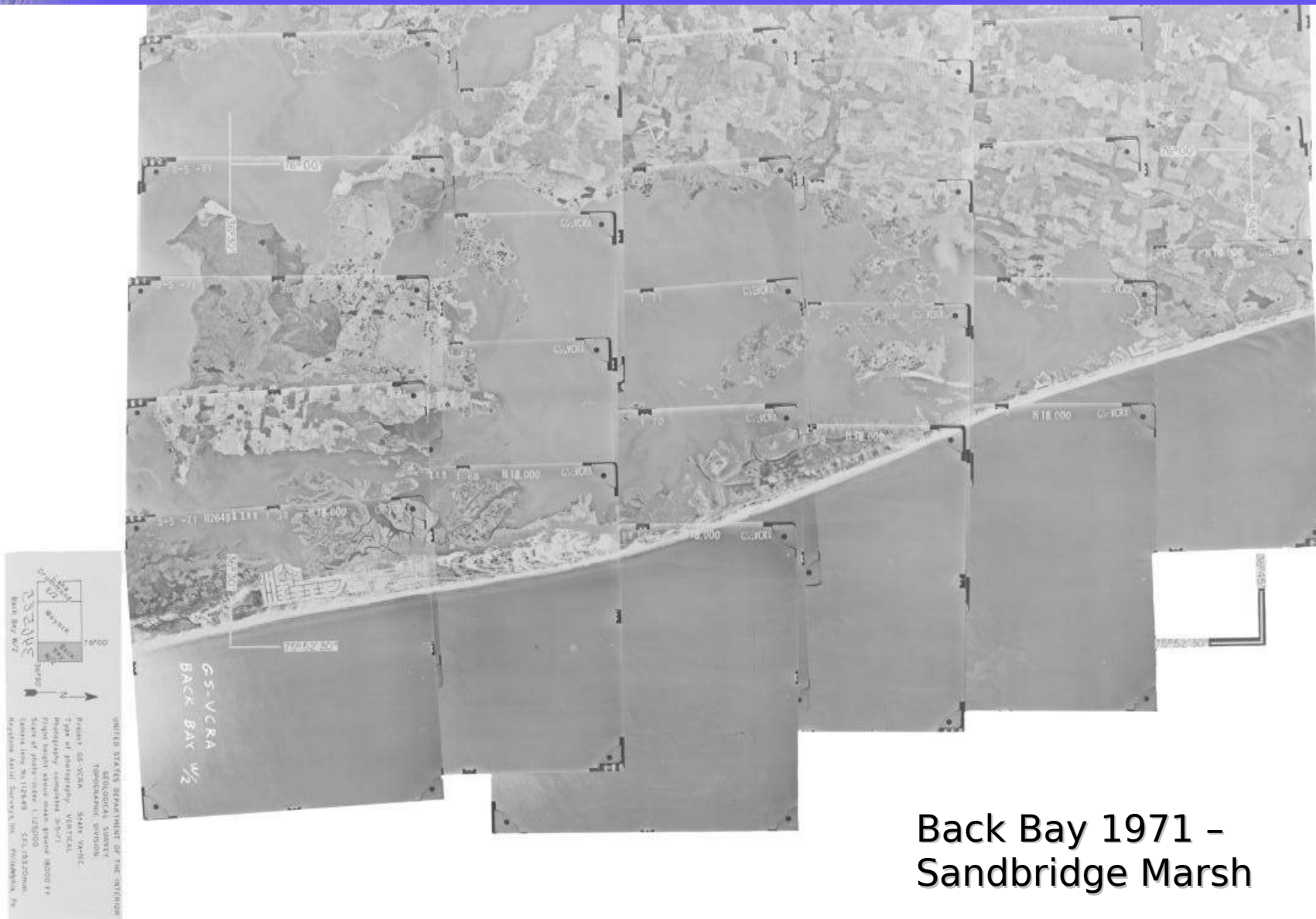
Landsat bands 4, 5, 2
19950904

Misc. Interesting Stuff

Back Bay 1953 –
Sandbridge Marsh

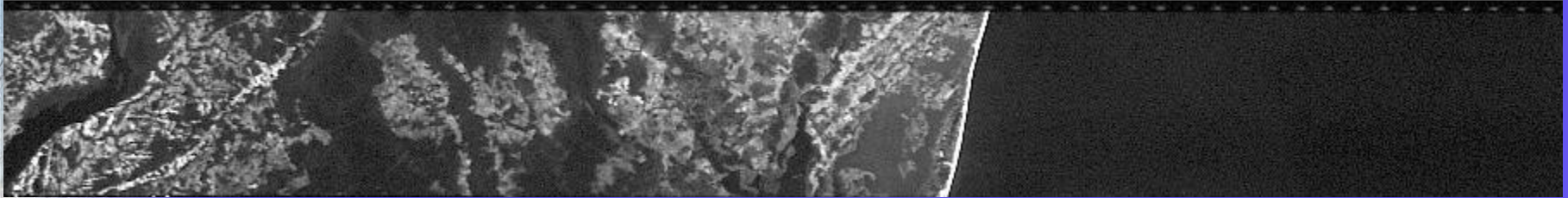


Misc. Interesting Stuff

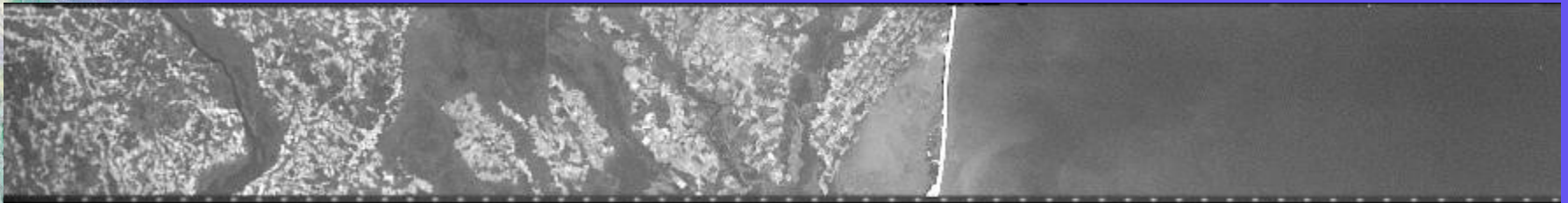


Back Bay 1971 -
Sandbridge Marsh

Misc. Interesting Stuff



KH-4 Declassified Satellite Imagery - 19631124



KH-4A Declassified Satellite Imagery - 19641226

The Way Forward

- ▶ Get feedback from Currituck Sound Study Team
- ▶ Evaluate more imagery dates
- ▶ Create maps of marsh loss over time
- ▶ Classify waterfowl and fishery habitat areas
- ▶ Identify any patterns
- ▶ Continue to utilize remote sensing techniques to assist in answering complex issues

